Ejecta Distribution Patterns Using Multiple 433 Eros Models

D.J. Schemes, D.L. Mitchell, S.J. Ostro (J]'] ./Caltech), 1 :.I. Asphaug (NASA/Al< C), R.S. Hudson (Washington State Univ.)

We use three different models of asteroid 433 Eros (1).1.. Mitchell et al., submitted to Icarus, 1996) to study the relation between asteroid shape and patterns of ejecta redistribution. Each model is based on Goldstone radar spectra from Eros' 1975 close approach (Jurgens and Goldstein 1 976, Icarus 28, 1-1 5). The models are a triaxial ellipsoid anti two non-axisymmetric shapes all constrained to be in principal-axis rotation. Both non-axisymmetric shape,: exhibit one. or more large concavities on one side of the asteroid while the opposing side is highly convex.

The simulated impacts map two-dimensional impact ejecta fields computed for consolidated and unconsolidated basalt onto the three-ditncnsional asteroid model. The initial ejecta field is symmetric about the impact axis and the impacts occur normal to the surf ace,. Each particle in the ejects field is assigned a volume so the mass flow of the ejecta field over the asteroid can be tracked These impacts are. applied at different points on the asteroid surface, detailed dynamical trajectories for each particle are. computed, and original and fins positions are recorded. The dynamical simulations include a coefficient o restitution that allow the particles to re-impact the surface multiple times.

As pm.dieted by theory (Scheeres, et al. 1996, Icarus **121**, 67-87), the ejecta fields tend to migrate towards the leading edges of the asteroid. Inclusion o multiple particle impacts cause the ejecta fields to be more widely distribute and lead to a subtle yet persistent migration of the ejecta towards the. equator Should these general trends persist under different conditions and assumptions the cumulative effect of non-catastrophic impacts would be to re-distribute asteroid mass from the. poles and trailing edges of the body to the equato and leading edges. Local topography can influence the final ejecta distribution and, in specific regions, can mask general trends. For example, the larger concavities can trap eje.eta fields and redistribute them within their general boundaries. These results may have broad implications for our understandin of the evolution of asteroid shapes and spin states.